AC NO: 91-46

DATE: 2/4/77

ADVISORY CIRCULAR

DEPARTMENT Of TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

SUBJECT: GYROSCOPIC INSTRUMENTS - GOOD OPERATING PRACTICES

1. PURPOSE. This advisory circular is issued to reemphasize to general aviation instrument-rated pilots the need to determine the proper operation of gyroscopic instruments, the importance of instrument cross-checks and proficiency in partial-panel (emergency) operations.

2. FOR ADDITIONAL INFORMATION, REFER T0:

   a. Instrument Flying Handbook, AC 61-27B.

   b. Maintenance and Handling of Air-Driven Gyroscopic Instruments, AC 91-26.

3. BACKGROUND. The National Transportation Safety Board (NTSB) and the Federal Aviation Administration (FAA) recently reviewed several fatal general aviation accidents which occurred in instrument meteorological flight conditions (IMC) during the past few years. These accidents involved instrument-rated pilots of small aircraft. In a number of these accidents, a malfunctioning vacuum system or flight instrument was determined to be a cause or a contributing factor.

4. DISCUSSION. An analysis of approximately 125 accidents covering a ten year period (January 1964 through December 1974) indicates weather related accidents fall primarily into two general categories with definite poor pilot practices associated with each as follows:

   a. Departure into IMC with an inoperative instrument(s) -- inadequate preflight inspection.

   b. Failure of instruments) during an IMC operation -- failure to maintain partial panel proficiency or inadequate instrument cross-check.

5. PREFLIGHT INSPECTION. The preflight check of the gyro-operated instruments and their power sources takes on additional importance when flight

Initiated by: AFS-804/820

in IMC is proposed. In addition to the normal IFR and VFR preflight check, the following flight instrument checks should be stressed.

a. Before starting:

(1) Check instruments for poor condition, mounting, marking, broken or loose knobs. Also check the power-off indications of the instrument pointers and warning flags.

(2) Check heading and attitude indicators to ascertain that they are uncaged. Check turn and slip indicator and magnetic compass for fluid level (should be full).

(3) Check condition and security of outside mounted venturi if aircraft is so equipped.

(4) If instruments are electrical, turn on and listen for any unusual or irregular mechanical noise.

b. After starting engine -- check instruments for erratic or intermittent operation, excessive warm up or erection time and that warning flags, indicating lights and the test circuits are operable. Additionally, the following items should be checked:

(1) Adequacy of Power Source(s). Check the source of power for the gyro instruments. The suction or pressure developed should be appropriate for the instruments in that particular aircraft. If the gyros are electrically driven, check the generators and inverters for proper operation.

(2) Heading Indicator. Allow five minutes after starting engines for the gyro rotor of the vacuum-operated heading indicator to attain normal operating speed. Cage the gyro and uncage it, simultaneously pulling out and turning the knob. (If the card continues to turn, the gyro is not operating properly.) Before taxiing, or while taxiing straight, set the heading indicator to correspond with the magnetic compass heading. Before takeoff, recheck the heading indicator. If your magnetic compass and deviation card are accurate, the heading indicator should show the known taxiway or runway direction when the aircraft is aligned with them (within 5°).

Electric gyros should also be set and checked against known headings. Allow three minutes for the electric gyro to attain operating speed. A gyrosyn (slaved gyro) compass should be checked for slaving action and its indications compared with those of the magnetic compass.

(3) Attitude Indicator. Allow the same times as noted above for gyros to attain normal rotor speed. If the horizon bar erects

to the horizontal position and remains at the correct position for the attitude of the aircraft, or if it begins to vibrate after this attitude is reached and then slowly stops vibrating altogether, the instrument is operating properly. If the horizon bar fails to remain in the horizontal position during straight taxiing, or tips in excess of 5° during taxi turns, the instrument may be unreliable.

Adjust the miniature aircraft with reference to the horizon bar for the particular aircraft while on the ground. For some tricycle-geared aircraft, a slightly nose-low attitude on the ground will give a level flight attitude at normal cruising speed. (A mild precession from horizontal may be expected during sharp taxi turns.)

(4) Turn-and-Slip Indicator (Turn Indicator). Check the turn indicator for right and left deflection and for positive return to the center position. The check can be made by depressing one side of the shock-mounted panel and releasing it, or by noting indications during taxi turns. The ball should move freely in the tube and no bubbles should appear in the fluid.

6. CROSS-CHECK (SCAN). Most propeller-driven general aviation airplanes in use today utilize a vacuum/pressure power source for the attitude and direction indicators and electrically driven gyros for the turn indicator. These two systems provide the instrument pilot with a primary and backup method for aircraft control. Early detection of an instrument or instrument power failure will be assured if a proper cross-check is maintained. The proper division of attention and sequence of cross-check varies from pilot to pilot throughout the various phases of flight. A typical cross-check should consist of a glance at the attitude indicator then a glance at a performance instrument; back to the attitude indicator; then a glance at another performance instrument and back to the attitude indicator, etc. During the sequence of cross-check, the engine instruments, including the suction gauges) and ammeter/load meters, should be checked to ensure early detection of a malfunctioning instrument system power source. A loss of suction on aircraft which use vacuum power for the attitude and directional gyros would require immediate transition to the partial panel technique of instrument flying. It is for this reason that all pilots should maintain their proficiency in partial panel instrument flying. Flight instructors conducting biennial flight reviews or proficiency checks of instrument-rated pilots may wish to include a discussion and review of partial panel flight techniques.

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